Issued January 10, 1908.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE—Circular 134.
GIFFORD PINCHOT, Forester.

THE ESTIMATION OF MOISTURE IN CREOSOTED WOOD.

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1908

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THE ESTIMATION OF MOISTURE IN CREOSOTED WOOD.

INTRODUCTION.

Determinations of the amount of water present in timbers treated with preservative solutions are frequently useful. When the wood has been treated with zinc chlorid, mercuric chlorid, or other preservative in aqueous solution, the moisture estimations are as readily made as those on untreated woods, but it is difficult to make moisture estimations when creosote is the preservative. Moisture determinations on wood are ordinarily made by drying a portion of wood at or near 100° C. and weighing it frequently until no further loss of weight occurs. The percentage of moisture is readily calculated from original and final weights. If this procedure is attempted with creosoted wood, the creosote goes off with great rapidity and the loss of weight is due to loss of creosote as well as to loss of moisture.

A method for determining moisture in creosoted timber would be valuable in experimental work. The need of such a method was recognized in the Forest Service when a study was made of the strength of treated timbers. It was known that small percentages of moisture affect in a marked degree the strength of wood, and determinations of the water content of all the creosoted timbers which were tested would have been desirable. Furthermore, in conducting treating experiments it is often desirable to determine the efficiency of the steaming or other artificial seasoning methods, and a means of estimating the moisture content of the treated timber would frequently be useful.

In commercial operations, too, a means of estimating moisture in creosoted timber would be of value. When creosoted timber is purchased on contract, the purchaser ought to be able to tell whether or not he is getting seasoned or green timber. Unless the amount of water in the wood is known, the weight of creosoted timber indicates but little, since green wood with a light treatment might have the same specific gravity as seasoned material with 20 pounds of creosote per cubic foot.

DEVELOPMENT OF A METHOD.

A number of unsuccessful attempts were made to devise a satisfactory method for estimating the moisture in creosoted wood. It was not possible to drive off the moisture in a current of air and to absorb

the water by calcium chlorid or sulphuric acid, because the naphthalene of the creosote sublimed and plugged up the tubes.

In 1904 J. Marcusson published a method for estimating the water and acid content of lubricants.[a] The method of estimating water was, briefly, as follows: One hundred grams of lubricant was placed in a wide-mouth 1,000 cubic centimeter Erlenmeyer flask, the upper part of which was covered with asbestos; 100 grams of toluol and some pieces of pumice stone were added, and the mixture was distilled on an oil-bath until the distillate came in clear drops. The distillate, which consisted of an emulsion of toluol and water, was caught in a 100 cubic centimeter cylinder, where, after standing, the two liquids separated. The percentage of water in the fat could then be read directly from the volume of the lower liquid layer. Marcusson[b] later extended his methods to oils, soaps, resins, etc., and made some changes in the details of procedure. The important change is the substitution of water-saturated xylol for toluol.

It seemed probable that Marcusson's method, or a modification of it, might be used on creosoted wood. Preliminary trials were carried out in two ways. In the first, a sample of moist uncreosoted wood was divided in two portions; the moisture content of one portion was determined by the ordinary method of oven drying and the moisture in the other by the xylol distillation method.

OVEN DRYING.

Weight of moist chips	4.7781 grams.
Loss on drying	1.2537 grams.
Percentage of moisture	26.2

XYLOL DRYING.

Ten grams of wood was placed in a 250 cubic centimeter Erlenmeyer flask, 50 cubic centimeters of water-saturated xylol added, and the mixture was heated in a paraffin bath. The distillate was caught in a burette which had been filled with water to the point where the graduations begin. The volume of the water in the distillate was 2.6 cubic centimeters, equivalent to 26 per cent of moisture in the wood examined.

Another preliminary test was made by adding dry creosote, and a measured volume of water, to oven-dried wood, and trying the distillation method on the mixture. Five grams of oven-dried wood was placed in a 250 cubic centimeter Erlenmeyer flask; to this were added 2 cubic centimeters of distilled water (measured from a bu-

[a] Bestimmung des Wasser-und Säuregehaltes von Schmierfetten. J. Marcusson, Mitt. K. Materialprüfungsamt, **22**, 48.

[b] Die Bestimmung des Wassergehaltes von Ölen, Fetten, Seifen, Harzen, usw., J. Marcusson, Mitt. K. Materialprüfungsamt, **23**, 58.

rette) and 4.1 grams of dry creosote. Fifty cubic centimeters of water-saturated xylol was added and the mixture was distilled from a paraffin bath, the distillate being collected in a burette. Precisely 2 cubic centimeters of water was recovered. A small amount of creosote necessarily distilled with the xylol and water, but remained dissolved in the xylol and did not influence the volume of water.

In order to get accurate results, it is necessary to use at least 25 grams of wood, requiring 75 to 100 cubic centimeters of xylol. It is likewise necessary to read the volume of the separated water to tenths of a cubic centimeter, a difference of 0.1 cubic centimeter being equal to 0.4 per cent in the moisture content when 25 grams of wood are used. A burette is too small and awkward, and the ordinary graduated cylinder not sufficiently accurate. The special form of graduate shown in figure 1 was devised for this work. The water, sinking into the lower portion which is graduated to tenths of a cubic centimeter, can be accurately measured, and the excess of xylol is held in the funnel-shaped top. The graduates must be held in a rack or other suitable support.

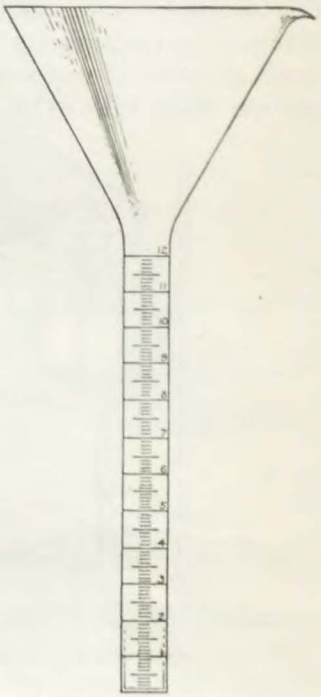

FIG. 1.—Form of graduate used.

The influence of coarseness of material and of speed of distillation were brought out in the following tests. The moisture in chestnut wood in the form of coarse borings was found by oven drying to be 48.65 per cent. The moisture was also determined by the xylol method, both with and without the addition of dry creosote, the distillations being run rapidly; only 48 per cent of water was found in each case. With chestnut fine turnings, oven drying showed 40.75 per cent of water, and analysis by distillation, both with and without the addition of creosote, at the rate of about 1 drop per second showed an average moisture content of 40.6 per cent.

ANALYTICAL PROCEDURE.

A convenient arrangement for occasional analysis is shown in figure 2.

The creosoted wood, in the form of borings, turnings, sawdust, or similar material, is quickly weighed and transferred to the 250 cubic centimeter Erlenmeyer flask, and 75 cubic centimeters of water-

saturated xylol [a] added. The basin, which might well be of smaller diameter than that shown in figure 2, should be two-thirds full of melted paraffin or of some heavy lubricating oil, such as cylinder oil. The bath is heated and the distillation continued until the distillate comes in clear drops. At the end of the distillation the condenser should be rinsed with the stream from a wash bottle containing xylol. After it has stood for a short time, the emulsion of water and xylol separates, giving two clear liquid layers. The mean of the readings at the top and bottom of the meniscus, between xylol and water, gives the volume of water, and the percentage of moisture in the wood is obtained by multiplying the water volume by 4. There are always small globules of water adhering to the sides of the graduate in the portion filled with xylol. These are readily scrubbed down with a

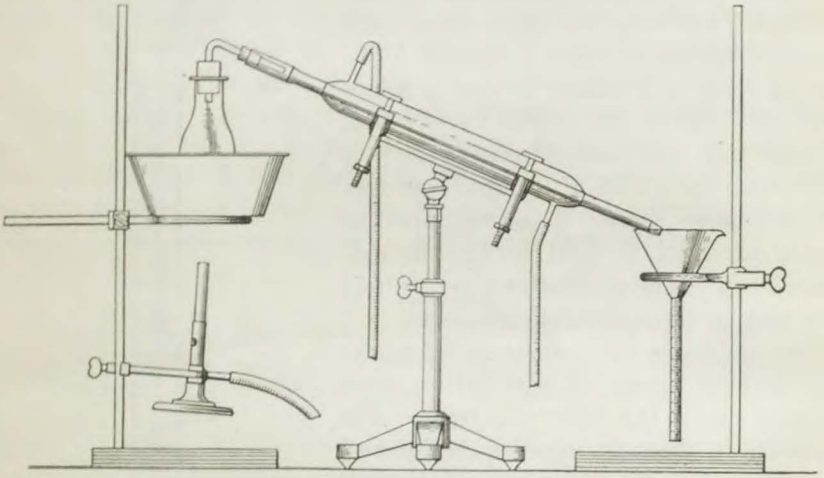

FIG. 2.—Apparatus for making single estimations of moisture in creosoted wood.

piece of rubber tube on the end of a piece of glass tubing, which is better for this purpose than the rod commonly used for a "policeman."

It is important that the distillation be carried on slowly to allow all the water in the wood to volatilize. The finer the wood particles, the more rapid may be the distillation. If rather coarse material is used, the distillation should not run faster than 1 drop per second.

The apparatus shown in figure 3 was devised for making large numbers of moisture estimations on creosoted wood. The compartments of the paraffin bath are larger than necessary for the 250 cubic centimeter flasks, but the apparatus was designed so that

[a] Water-saturated xylol is readily prepared by heating a mixture of water and xylol with frequent shakings and subsequently removing the water in a separatory funnel.

larger flasks might be employed when considerable wood was to be used, for purposes of investigation, to obtain very accurate results.

WATER IN CREOSOTE OILS.

Marcusson's method is well adapted to the estimation of water in creosote oils. The apparatus used for creosoted wood is satisfactory for creosote, except that a wire gauze should be substituted for the paraffin bath. The 250 cubic centimeter flask is weighed, 50 cubic centimeters of melted, well-shaken creosote introduced, and a second weight taken. Seventy-five cubic centimeters of water-saturated

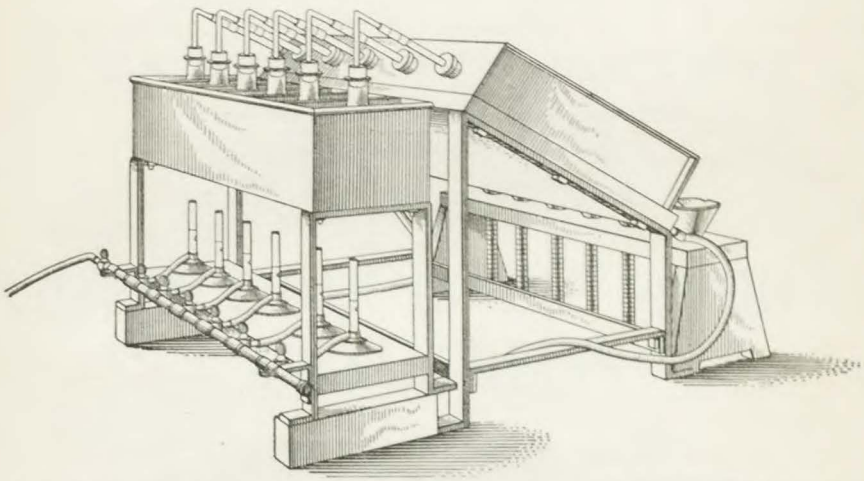

FIG. 3.—Apparatus for making several moisture determinations in creosoted wood.

xylol are added and the mixture distilled until the water ceases to come off. The percentage of water is obtained by dividing the volume (cubic centimeters) of water in the distillate by the weight (grams) of creosote. The results are likely to run one or two tenths of a per cent too low.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *November 11, 1907.*

[Cir. 134]

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